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A Research work on Extraction of Bioactive Compounds, from Pomegranate and Orange Peels

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ABSTRACT

Pomegranate (Punica granatum) and orange (Citrus sinensis) peels, commonly regarded as waste materials in the fruit processing industry, possess a wealth of bioactive compounds with significant potential for various applications. This study aimed to investigate the efficient extraction of bioactive compounds from pomegranate and orange peels using different extraction techniques and evaluate their potential applications in industries such as pharmaceuticals, food, cosmetics, and agriculture. A comprehensive literature review was conducted to understand the composition of pomegranate and orange peels and to identify suitable extraction methods for maximizing the yield of bioactive compounds. Various extraction techniques including solvent extraction, microwave-assisted extraction, ultrasound-assisted extraction, and supercritical fluid extraction were evaluated to determine their effectiveness in extracting phenolic compounds, flavonoids, antioxidants, and other bioactive constituents.

The extracted compounds were analysed using advanced analytical techniques such as HPLC, FTIR, and UV-Vi's spectroscopy to identify and quantify individual compounds present in the extracts. Additionally, the antioxidant activity of the extracts was assessed using DPPH and ABTS assays. Characterization studies were conducted to evaluate the physical and chemical properties of the extracts, including colour, viscosity, p^H, and stability. Furthermore, the functional properties of the extracts such as emulsifying, foaming, and gelling properties were determined. The potential applications of the extracted compounds were explored, including their use as natural preservatives, antioxidants, antimicrobial agents, anti-inflammatory agents, and anticancer agents in various industries. Sustainability and economic viability of large-scale extraction processes were also evaluated, considering the environmental impact and cost-effectiveness of different extraction methods.

Overall, this research provides valuable insights into the extraction of bioactive compounds from pomegranate and orange peels and highlights their potential as valuable resources for the development of functional ingredients with diverse applications in the pharmaceutical, food, cosmetic, and agricultural sectors.

Keywords: Pomegranate peel extract, antibacterial, Staphylococcus epidermidis, Staphylococcus aureus, peel-off mask Propionibacterium acnes

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INTRODUCTION

POMEGRANATE PEELS EXTRACT

Acne vulgaris is skin disorder that results of pilosebaceous follicles obstruction. Normally, it is located primarily on face and upper body [1].The main factor involved in the pathogenesis of acne is the abnormality in colonization of normal flora including Staphylococcus aureus (S. aureus), Staphylococcus epidermidis (S. epidermidis) and Propionibacterium acnes (P. acnes). S. aureus and S. epidermidis are gram-positive aerobic organisms. They are the opportunistic pathogens, usually involve in superficial infection within the sebaceous units [2]. For P. acnes, it is an immobile and gram-positive anaerobe that colonizes in the follicular duct. It provokes an inflammatory response by its capability to activate the bacterial enzyme (lipase) that metabolizes the sebaceous triglycerides into free fatty acids, which results in follicular wall irritation [3,4].

Generally, the common therapy for acne treatment includes topical therapy employing comedolytics and antibiotics. These comedolytics and antibiotics have several adverse effects on skin irritation, dry skin, peeling, burning, photosensitization and abnormal skin pigmentation. Moreover, the antibiotics resistance has been increasing in prevalence because of the widespread use of synthetic antibiotics in dermatological treatment [5]. Thus, the concept of applying the natural innovation to use as the anti-acne product should be considered as alternative. Even though most natural products have anti- microbial activity that is less potent than that of antibiotics, their different bactericidal actions may be capable to battle with the antibiotic-resistant bacterial strains.

Pomegranate (Punica granatum L.) is a fruit that is commonly found in various countries. All parts of this fruit can be used for remedial purposes in medical terms [6]. The phenolics in pomegranate peel extract (PPE) has demonstrated the outstanding in the anti-bacterial activity [7,8], especially the potent bacteriostatic effect against the bacteria S. aureus, S. epidermidis and P. acnes [8,9]. Basically, the phenolic compounds in PPE can treat through3 main activities; anti-bacterial activity [7,9], anti- inflammation [7,10] and anti-oxidation [11].They suppress the production of substrates or the synthesis of bacteria products, which then reduce the burden of acne. To obtain the phenolic compounds from the pomegranate peel, harmful organic solvents such as methanol, acetone, ethyl acetate are commonly used [12].

The using of these organic solvents leads to environmental problems and also can cause adverse effects on health. However, the studies of [13,14] reported that ethanolic PPE provided the notable anti-oxidant extracting efficiency using Ferric Reducing Ability of Plasma (FRAP) assay, is presented as a general method for assessing anti-oxidant power and high yield of the active total phenolic content using Folin-Ciocalteu, according to its polarity, solubility, hydrophilicity, dielectric constant. Thus, in this study we are interested in ethanolic PPE to further determine anti- bacterial efficacy; to enhance the efficacy of the PPE for acne treatment, the design of an effective delivery device is important. Film mask is one of the dosage forms that attracts our attention as it generally enhances the transport of active compounds by altering the skin barrier functions through increasing hydration of stratum corneum [15].

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Acne is a skin disease that is often found in Indonesian society [16].Acne vulgaris is a chronic inflammatory disease of the pilosebaceous follicles which is characterized by the presence of comedones, papules, nodules, and pustules [17]. Indonesian Cosmetic Dermatology reports that the percentage of people suffering from acne is increasing every year, 60% in 2006, 80% in 2007 and 90% in 2009. Treatment to treat acne both physically and chemically requires a relatively high cost because it must be done repeatedly by professionals. Physical treatments include facial and laser therapy, then chemical treatments such as the use of pharmaceutical preparations containing antibiotics.

The topical use of antibiotics can cause side effects including irritation and allergies. In addition, long-term use of antibiotics can cause resistance and trigger hypersensitivity reactions [18]. The pomegranate plant (Punica granatum L.) has been used naturally to treat sore throats, coughs, urinary tract infections, digestive disorders, skin disorders, arthritis, and to treat tapeworms [19]. Several phytochemical compounds from pomegranate peels are known to inhibit the growth of pathogenic bacteria. Previous research stated that pomegranate peel contains bioactive compounds that have potential as antibacterial in the form of alkaloids, phenolics, flavonoids, ellagitannins, and proanthocyanidins [20]. Based on the research results of [21] pomegranate peel extract was able to inhibit the growth of Staphylococcus aureus bacteria, with MIC and MBC values of 25 mg/ml and 50 mg/ml, respectively. This is in line with research conducted by [20] which showed that pomegranate peel extract had antibacterial activity against Enterococcus faecalis, Staphylococcus epidermidis, Klebsiella oxytoca, Enterobacter bugandensis.

A peel-off face mask is a type of face mask that can be easily removed like an elastic membrane, so it is considered more practical because it makes it easier for users to clean products from facial skin [22].At the time of removing the peel-off mask from the face, dead skin cells and dirt/sebum on the face can also be removed to reduce the potential for pore blockages which can cause acne [23]. In addition, the use of gel-based peel-off facial masks is also beneficial in hydrating the skin because most of its composition is water [24]. Therefore, this study aims to look at the antibacterial activity of peel off mask preparations of pomegranate peel extract (Punica granatum L.) extracted with 96% ethanol against Staphylococcus epidermidis and Staphylococcus aureus.

Fig:1 Extract of pomegranate peel

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ORANGE PEEL EXTRACT

Orange peel extract is a natural substance derived from the outer peel or zest of oranges, the citrus fruit known for its sweet and tangy flavor. The extract is obtained by processing and concentrating the oils and bioactive compounds found in orange peels. It is commonly used in various applications, including culinary, skincare, and aromatherapy, due to its potential health and therapeutic benefits.

Essential Oils: Orange peel extract is rich in essential oils, particularly limonene, which is responsible for the characteristic citrus fragrance.

Flavonoids: Flavonoids are a group of bioactive compounds with antioxidant properties, found in orange peels.

Vitamins: Orange peel extract contains vitamins, including vitamin C, which is an antioxidant and can promote skin health.

Citrus Bioflavonoids: These compounds may havepotential anti-inflammatory and antioxidant effects.

Orange peel extract is valued for its various uses:

Culinary: It is used to flavor and add fragrance to foods and beverages. Dried orange peel or zest is often used in cooking and baking.

Skincare: In skincare products, orange peel extract can contribute to skin brightening, thanks to its vitamin C content. It may also have astringent properties, making it suitable for oily or acne-prone skin.

Aromatherapy: The invigorating scent of orange peel extract is commonly used in aromatherapy to uplift mood and reduce stress.

Natural Cleaners: Orange peel extract's degreasing properties make it a common ingredient in natural household cleaners.

Digestive Health: In traditional medicine, orange peel extract has been used to support digestion and alleviate digestive discomfort.

When used topically in skincare products, it's typically in a diluted form and can help improve skin texture, reduce signs of aging, and provide antioxidant protection.

How Orange Peel Extract help with acne

Orange peel extract is effective for brightening and reducing acne scars or hyperpigmentation, removing excess oil, reducing inflammation, and fighting free radicals. It has potential benefits

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for managing acne due to several of its properties:

Astringent Properties: Orange peel extract contains astringent compounds that can help tighten and tone the skin. This property may be particularly beneficial for individuals with oily or acne-prone skin, as it can reduce the appearance of large pores and help control excess oil production.

Vitamin C Content: Orange peel extract is a source of vitamin C, which is known for its antioxidant properties. Antioxidants help protect the skin from damage caused by free radicals, which can exacerbate acne and contribute to skin inflammation.

Anti-Inflammatory Effects: The vitamin C and flavonoids in orange peel extract have anti-inflammatory properties that can help reduce redness and inflammation associated with acne breakouts. These compounds may soothe and calm irritated skin.

Exfoliation: The extract may have mild exfoliating properties due to its natural acids. This can help remove dead skin cells, unclog pores, and reduce the likelihood of new acne lesions forming.

Skin Brightening: Vitamin C in orange peel extract can contribute to skin brightening and may help fade acne scars and hyperpigmentation, promoting a more even complexion.

Antimicrobial Effects: Some components of orange peel extract have mild antimicrobial properties that could help inhibit the growth of acne-causing bacteria.

Orange peel extract offers several potential benefits for acne-prone skin, it helps breakouts and protects skin from free radicals [25] It belongs to the subclass of flavanones and is known for its antioxidant and anti-inflammatory properties.

Hesperidin is recognized for its potential health benefits, including supporting cardiovascular health, promoting blood vessel health, and boosting immune system.

Fig:2 Extract of orange peel

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LITERATURE REVIEW

(**JJ Leydwn *et.al*.1917**)

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(A Zarfeshany*et.al*.2014)

The concept of applying the natural innovation to use as the anti-acne product should be considered as alternative. Even though most natural products have anti- microbial activity that is less potent than that of antibiotics, their different bactericidal actions may be capable to battle with the antibiotic-resistant bacterial strains. Pomegranate (Punica granatum L.) is a fruit that is commonly found in various countries. All parts of this fruit can be used for remedial purposes in medical terms.

(Sahala *et.al*.2013, Amalia*et.al*. 2019, Sibero*et.al*.2019)

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(Fauziah, F. *et.al*.2020)

A peel-off face mask is a type of face mask that can be easily removed like an elastic membrane, so it is considered more practical because it makes it easier for users to clean products from facial skin. At the time of removing the peel-off mask from the face, dead skin cells and dirt/sebum on the face can also be removed to reduce the potential for pore blockages which can cause acne.

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Orange peel extract is a natural substance derived from the outer peel or zest of oranges, the citrus fruit known for its sweet and tangy flavor.

RESEARCH ENVISED

This study aims to make peel-off masks of the ethanol extract of pomegranate peels and extract of orange peels and to determine the antibacterial activity against culinary, skincare, and aromatherapy, due to its potential health, therapeutic benefits and acne-causing bacteria Staphylococcus epidermidis and Staphylococcus aureus.

Research on the extraction of compounds from pomegranate peels and orange peels is quite promising due to the abundance of bioactive compounds present in these fruit residues. Both pomegranate and orange peels are rich sources of phenolic compounds, flavonoids, antioxidants, and other beneficial compounds that have potential applications in various industries, including pharmaceuticals, food, cosmetics, and agriculture.

Here's an outline of a research plan for investigating the extraction of compounds from pomegranate and orange peels:

PLAN OF WORK

1.Exhaustive literature survey

2.Procurement of chemical

3.Prepration of face pack powder form

4.Identification of compound: -

a. physical characteristics

b.solubility

c. Determination of p^H

d.TLC

5.Evaluction of pharmacological activity

a. Anti-bacterial

6.Composition of data and presentation

7.Report writing and Publication

PREPARATION OF FACE MIST

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Creating a homemade face mist peel using pomegranate and orange peels can be a fun and beneficial project. Here's a step-by-step plan for preparation:

A] Gather Ingredients and Tools

1. Pomegranate peels from local market
2. Orange peels from local market
3. Distilled water from chemistry lab of SIR MADANLAL INTITUTE OF PHARMACY COLLEGE U.P.
4. A clean glass jar with a tight-fitting lidchemistry lab of SIR MADANLAL INTITUTE OF PHARMACY COLLEGE U.P.
5. Cheesecloth or fine mesh strainer from local market.
6. Spray bottle for mist application from local market.

B] General preparation of method

Wash the pomegranate and oranges thoroughly to remove any dirt or pesticides.

Peel the outer skin of both fruits, ensuring to remove any white pith as much as possible, as it can make the solution bitter.

Cut the peels into smaller pieces to increase their surface area and aid in extraction.

Step 3: Extraction Process

Place the pomegranate and orange peels in separate sections of the glass jar.

Pour distilled water over the peels until they are completely submerged.

Seal the jar tightly with the lid.

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Step 4: Infusion Period

Store the jar in a cool, dark place away from direct sunlight.

Allow the peels to infuse in the water for at least one to two weeks. The longer they steep, the more potent the infusion will be.

Step 5: Straining the Infusion

After the infusion period, open the jar and strain the liquid using a cheesecloth or fine mesh strainer to remove any solid particles.

Squeeze out any excess liquid from the peels to extract all the goodness.

Step 6: Bottle the Face Mist Peel

Transfer the strained liquid into a clean spray bottle for easy application.

Label the bottle with the ingredients and date of preparation for future reference.

Step 7: Storage and Usage

Store the face mist peel in the refrigerator to prolong its shelf life and maintain freshness.

Shake well before each use to ensure even distribution of the infused liquid.

To use, simply spray the mist onto clean skin as needed, avoiding the eye area. Allow it to air dry or gently pat it into the skin.

RESULT

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Pomegranate and orange peel extract offer a range of potential health benefits due to their rich nutrient content. Here are some potential results or benefits associated with consuming or using these extracts:

1. **Antioxidant Properties**: Both pomegranate and orange peel contain antioxidants such as flavonoids, phenolics, and vitamin C, which can help neutralize harmful free radicals in the body, reducing oxidative stress and inflammation.

2. **Anti-Inflammatory Effects**: Compounds found in pomegranate and orange peel extract may possess anti-inflammatory properties, which can help alleviate symptoms of inflammatory conditions like arthritis and promote overall health.

3. **Skin Benefits**: Both pomegranate and orange peel extract contain compounds that are beneficial for the skin, such as vitamin C and antioxidants. These extracts may help protect the skin from sun damage, reduce signs of aging, and promote a healthy complexion.

4. **Immune Support**: The vitamin C content in both pomegranate and orange peel extract can boost the immune system, helping the body fight off infections and illnesses.

It's important to note that while these extracts offer potential health benefits, more research is needed to fully understand their effects and optimal dosage. Additionally, individual results may vary, and it's always best to consult

IDENTIFICATION OF COMPOUND

1.PHYSICALCHARATERSTICS:

The face pack derived from the extract of pomegranate and orange peels exhibits a range of physical characteristics that contribute to its efficacy and appeal in skincare. Here's an exploration of these attributes:

1. **Texture**: The face pack typically possesses a finely powdered texture due to the ground pomegranate and orange peel extracts. This texture allows for easy application and smooth spreadability across the skin. It feels granular yet gentle, providing a mild exfoliating effect as it is massaged onto the skin.

2. **Color**: The color of the face pack is influenced by the natural hues of pomegranate and orange peels. Pomegranate peels tend to contribute a reddish-brown color, while orange peels impart a vibrant orange-yellow hue. The combination of these color results in a visually appealing shade that reflects the natural origins of the ingredients.

3. **Aroma**: One of the most captivating aspects of the face pack is its refreshing and invigorating aroma. The citrusy fragrance of oranges blends harmoniously with the slightly sweet and tangy

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scent of pomegranates. This aromatic profile not only enhances the sensory experience during application but also uplifts the mood and senses.

4. **Consistency**: When mixed with liquid ingredients such as water, honey, yogurt, or rose water, the powdered extracts form a smooth and creamy paste. The consistency may vary based on the ratio of powder to liquid and the specific additional ingredients used. However, it is generally thick enough to adhere to the skin without dripping, allowing for comfortable wear during the treatment period.

5. **Adhesion**: Once applied to the skin, the face pack adheres well, forming a thin, even layer that covers the targeted areas. This adherence is essential for maximizing the contact between the beneficial compounds present in the extract and the skin's surface, ensuring optimal absorption and effectiveness.

6. **Packaging and Presentation**: Depending on whether it's homemade or commercially produced, the face pack may be presented in various forms of packaging, such as jars, tubes, or sachets. Clear labelling and attractive design elements often complement the product's natural appeal, conveying its botanical origins and skincare benefits.

In summary, the face pack derived from pomegranate and orange peels boasts a pleasing array of physical characteristics, including its finely textured consistency, vibrant color, refreshing aroma, smooth adhesion, and appealing presentation. These attributes not only enhance its aesthetic appeal but also contribute to its effectiveness in promoting healthy, radiant skin.

Fig: 3 Mixture of both pomegranate and orange peel abstract

2.SOLUBILITY: The solubility of a face pack formulated with extracts of pomegranate and orange peels primarily depends on the ingredients used in its preparation. Pomegranate and orange peels contain various bioactive compounds, including polyphenols, flavonoids, and essential oils, which contribute to both the solubility and efficacy of the face pack. Here's an exploration of the solubility aspects:

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Water Solubility: Many of the beneficial compounds present in pomegranate and orange peels are water-soluble, meaning they can dissolve in water. When the powdered extracts of these peels are mixed with water or other aqueous solutions during the preparation of the face pack, these compounds become readily soluble, allowing them to be effectively transferred to the skin upon application. Water serves as a medium for extracting and dispersing the soluble constituents, facilitating their absorption into the skin's surface layers.

1. **Solubility in Hydrophilic Solvents**: Besides water, certain bioactive compounds in pomegranate and orange peels may also exhibit solubility in hydrophilic solvents such as glycerine, aloe vera gel, or rose water. These solvents possess properties that enable them to dissolve and extract specific compounds from the powdered extracts, enhancing the overall solubility and bioavailability of the active ingredients in the face pack formulation. Incorporating such solvents into the preparation process can help optimize the solubility profile of the face pack and enhance its skincare benefits.

2. **Emulsification**: In some formulations, emulsifiers or surfactants may be added to the face pack to improve the solubility and stability of the ingredients. Emulsifiers help disperse both water-soluble and oil-soluble components uniformly throughout the formulation, ensuring a homogeneous mixture with enhanced solubility properties. This emulsification process aids in maintaining the integrity of the face pack and promotes efficient delivery of the active constituents to the skin.

3. **Lipid Solubility**: While many of the compounds in pomegranate and orange peels are water-soluble, some may also exhibit lipid solubility, meaning they can dissolve in oils or lipid-based carriers. Incorporating lipid-soluble ingredients or carriers into the face pack formulation can help solubilize these compounds, broadening the range of bioactive constituents that can be effectively delivered to the skin. Lipid-based solubilization techniques may be particularly beneficial for enhancing the absorption of certain fat-soluble vitamins and antioxidants present in the peel extracts.

In summary, the solubility of a face pack formulated with extracts of pomegranate and orange peels is influenced by various factors, including the water solubility of bioactive compounds, the use of hydrophilic solvents, emulsification techniques, and lipid solubility considerations. By carefully selecting ingredients and formulating the face pack to optimize solubility, it is possible to create a skincare product that effectively delivers the therapeutic benefits of pomegranate and orange peel extracts to the skin, promoting its health and vitality.

3.DETERMINATION OF P^H:

Determining the pH of a face pack formulated with extracts of pomegranate and orange peels is essential for ensuring its compatibility with the skin's natural pH and optimizing its effectiveness. Here's a comprehensive explanation of the process and its significance:

1. **pH Measurement**: pH refers to the acidity or alkalinity of a solution and is measured on a scale ranging from 0 to 14, with 7 being neutral. The pH of skincare products, including face packs, plays a crucial role in maintaining the skin's acid mantle, a protective barrier that helps defend against environmental stressors and microbial pathogens. To determine the pH of the face pack, a pH meter or pH testing strips can be used.

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2. **Acidic Nature of Fruit Extracts**: Both pomegranate and orange peels contain natural acids, such as citric acid, malic acid, and ascorbic acid (vitamin C), which contribute to their characteristic tangy flavours and antioxidant properties. These acids can influence the pH of the face pack, typically making it acidic in nature. The pH of freshly prepared fruit extracts from pomegranate and orange peels may vary slightly but generally falls within the acidic range.

3. **Adjustment for Skin Compatibility**: While a slightly acidic pH is generally beneficial for the skin, excessive acidity can potentially cause irritation or discomfort, especially for individuals with sensitive or reactive skin. Therefore, it may be necessary to adjust the pH of the face pack to ensure optimal skin compatibility. This can be achieved by incorporating pH-modifying ingredients, such as mild acids (e.g., lactic acid) or alkaline substances (e.g., sodium bicarbonate), to achieve the desired pH level.

4. **Optimal pH Range**: The ideal pH range for skincare products, including face packs, is typically between 4.5 and 5.5, which is slightly acidic and closely matches the natural pH of healthy skin. Maintaining the pH within this range helps support the skin's protective barrier function, promotes hydration, and prevents overgrowth of harmful microorganisms.

5. **pH Testing Procedure**: To determine the pH of the face pack, a small sample is taken and mixed with distilled water to create a solution. The pH of the solution is then measured using a calibrated pH meter or pH testing strips. Multiple measurements may be taken at different points in the face pack formulation process to ensure consistency and accuracy.

6.Quality Control and Formulation Adjustments: Regular pH testing is essential as part of quality control procedures to ensure that the face pack consistently meets the desired pH specifications. If the pH falls outside the optimal range, appropriate adjustments can be made to the formulation to bring it into compliance.

In summary, the determination of pH in a face pack formulated with extracts of pomegranate and orange peels is critical for maintaining skin compatibility, supporting the skin's protective barrier function, and optimizing the effectiveness of the product. By carefully monitoring and adjusting the pH as needed, skincare manufacturers can create high-quality face packs that deliver the desired benefits while minimizing the risk of skin irritation or adverse reactions.

Fig: 4 P^H of pomegranate

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Fig:5 P^H of orange

4.THIN LAYER CHROMATOGRAPHY

Thin-layer chromatography (TLC) is a powerful analytical technique used to separate, identify, and quantify the components present in complex mixtures such as extracts derived from pomegranate and orange peels. When applied to the analysis of a face pack formulated with these extracts, TLC can provide valuable insights into the composition and purity of the product. Here's how TLC can be utilized in the evaluation of such a face pack:

1. **Sample Preparation**: To perform TLC on the face pack extract, a small amount of the sample is first dissolved or extracted using a suitable solvent. This ensures that the components of interest are in solution and can be applied evenly onto the TLC plate.

2. **Selection of TLC Plate and Mobile Phase**: A TLC plate with a suitable stationary phase, such as silica gel or alumina, is chosen based on the properties of the compounds present in the face pack extract. The mobile phase, which is a solvent mixture, is selected to facilitate the separation of the components. Common mobile phases for plant extracts include mixtures of organic solvents like ethyl acetate, methanol, and water.

3. **Application of Sample**: The prepared face pack extract is carefully spotted onto the TLC plate near the bottom edge, ensuring that the spots are small and well-defined to avoid overlap. Multiple samples or standards may be applied alongside the face pack extract for comparison purposes.

4. **Development of TLC Plate**: The TLC plate is placed in a developing chamber containing the chosen mobile phase. As the mobile phase ascends the plate by capillary action, it carries the components of the sample with it. Different compounds travel at different rates depending on their affinity for the stationary and mobile phases, leading to separation on the TLC plate.

5. **Visualization and Analysis**: After development, the TLC plate is removed from the chamber and dried. The separated components are visualized using suitable detection methods, such as UV light, staining reagents, or chemical sprays. Rf (retention factor) values, which represent the ratio of the distance travelled by a compound to the distance travelled by the solvent front, can be calculated to aid in identification.

6. **Interpretation of Results**: The TLC chromatogram obtained provides a visual representation of the components present in the face pack extract. By comparing the retention factors and spot patterns with those of known standards or reference compounds, the identity of the compounds can be tentatively determined. Additionally, the intensity of the spots can provide qualitative or semi-quantitative information about the relative abundance of the components.

7. **Quality Control and Optimization**: TLC can be used as a tool for quality control to ensure the consistency and uniformity of the face pack formulation. By monitoring the TLC profiles of

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batches produced under different conditions, manufacturers can identify optimal extraction methods, solvent systems, and formulation parameters to maximize the concentration of bioactive compounds and minimize impurities.

In summary, TLC is a valuable analytical technique for the characterization and quality assessment of face packs formulated with extracts of pomegranate and orange peels. By providing detailed information about the composition and purity of the product, TLC helps ensure its efficacy and safety for skincare applications.

Fig:6 Thin Layer Chromatography

R.F FORMULA

R.F. VALUE = Distance travelled by solute/ Distance travelled by solvent

= 5/6.5

= 0.76

EVALUATION OF PHARMACOLOGICAL ACTIVITY

ANTI-BACTERIAL:

Creating an antibacterial face pack using extracts from pomegranate and orange peels can be both effective and natural. Pomegranate and orange peels contain bioactive compounds with antimicrobial properties that can help combat bacteria and promote clearer, healthier skin. Here's how to formulate and utilize an antibacterial face pack with these ingredients:

1.Extraction of Bioactive Compounds: Begin by extracting the bioactive compounds from the pomegranate and orange peels. This can be achieved by drying the peels thoroughly and grinding them into a fine powder. Then, extract the powder using a suitable solvent such as water, alcohol, or a mixture of both, to obtain a concentrated extract rich in antimicrobial compounds.

2.Formulation of Face Pack: Combine the concentrated extracts from pomegranate and orange peels with other natural ingredients known for their antibacterial properties. For example, you

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can add honey, which has been used for centuries as a natural antibacterial agent, or tea tree oil, renowned for its antimicrobial and anti-inflammatory properties. Additionally, incorporating clay such as kaolin or bentonite can help draw out impurities and excess oil from the skin while providing a soothing effect.

3.Adjusting Consistency and Texture: Blend the ingredients together to create a smooth and consistent paste. Adjust the consistency by adding small amounts of water or other liquid ingredients until you achieve a spreadable texture that adheres well to the skin.

4.Application and Usage: Apply the antibacterial face pack to clean, dry skin, focusing on areas prone to bacterial growth or acne breakouts. Use gentle, circular motions to massage the pack onto the skin, ensuring even coverage. Leave the pack on for about 15-20 minutes to allow the antibacterial compounds to penetrate the skin and exert their effects. Rinse off thoroughly with lukewarm water and pat dry.

5.Frequency of Use I**ngredients**: Incorporate the antibacterial face pack into your skincare routine 2-3 times per week for optimal results. Consistent use can help reduce bacterial growth, minimize breakouts, and promote clearer, more radiant skin over time.

6.Storage and Shelf Life: Store any leftover face pack in an airtight container in the refrigerator to maintain its freshness and efficacy. Since natural ingredients are used, it's best to prepare the face pack in small batches to ensure maximum potency and shelf life. By harnessing the antibacterial properties of pomegranate and orange peel extracts along with other natural ingredients, you can create a potent and effective face pack to help combat bacteria, prevent acne breakouts, and promote healthier, clearer skin without relying on harsh chemicals or synthetic additives.

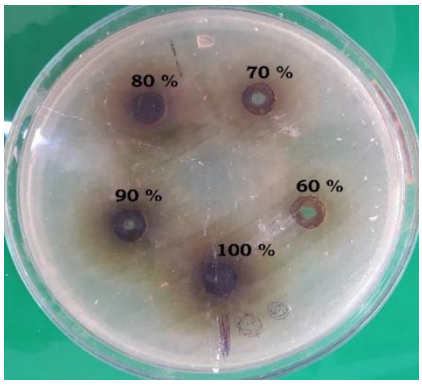

Fig7: Bacteria culture plate

ANTI-OXIDANT

An antioxidant face pack formulated with extracts from pomegranate and orange peels offers a natural and effective solution for promoting skin health and combating oxidative stress. Pomegranate and orange peels are renowned for their high antioxidant content, which helps protect the skin from damage caused by free radicals and environmental aggressors. Here's a comprehensive look at how to create and benefit from such a face pack:

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Preparation of Extracts: Begin by collecting fresh pomegranates and oranges, ensuring they are organic for optimal purity. Peel the fruits carefully, extracting only the outer skins while leaving behind the bitter white pith. Dry the peels thoroughly and grind them into a fine powder using a mortar and pestle or a food processor.

Combination with Additional Blend equal parts of the pomegranate and orange peel powders to create a balanced base for the face pack. To enhance its antioxidant potency and skincare benefits, consider incorporating other natural ingredients known for their antioxidant properties. For example, green tea extract, rich in polyphenols, can amplify the antioxidant capacity of the pack. Adding a teaspoon of vitamin E oil further boosts its protective effects and helps nourish the skin.

Application and Usage: Mix the powdered extracts and additional ingredients thoroughly to create a smooth paste. Apply the antioxidant face pack to clean, dry skin, avoiding the eye area. Allow it to sit for 15-20 minutes to allow the antioxidants to penetrate the skin and neutralize free radicals. Rinse off with lukewarm water and pat dry gently. For best results, use the face pack 2-3 times a week as part of your regular skincare routine.

Benefits for Skin: The antioxidant-rich formulation of the face pack offers a myriad of benefits for the skin. Pomegranate and orange peel extracts contain potent antioxidants, such as vitamin C, flavonoids, and polyphenols, which help protect the skin from oxidative damage, reduce inflammation, and promote collagen production. Regular use of the face pack can help improve skin texture, enhance radiance, and combat signs of aging, such as fine lines and wrinkles. Additionally, the nourishing and revitalizing properties of the pack leave the skin feeling refreshed, rejuvenated, and revitalized. In summary, an antioxidant face pack formulated with extracts from pomegranate and orange peels provides a natural and effective way to enhance skin health and vitality. By harnessing the power of antioxidants, this skincare treatment offers protection against environmental stressors, promotes youthful-looking skin, and leaves you with a radiant complexion that glows from within.

CONCLUSION

The combination of pomegranate and orange peel extract presents a potent fusion of natural ingredients with numerous potential health benefits and versatile applications. Pomegranates are renowned for their rich antioxidant content, including punicalagins, anthocyanins, and vitamin C, which help combat oxidative stress, inflammation, and cellular damage in the body.

Similarly, orange peel extract contains flavonoids like hesperidin and polymethoxyflavones, which possess antioxidant and anti-inflammatory properties, aiding in skin health and immune function.

Together, these extracts offer a synergistic blend that may promote overall well-being. The antioxidant properties of pomegranate and orange peel extract can protect cells from damage caused by free radicals, potentially reducing the risk of chronic diseases such as heart disease, cancer, and diabetes. Additionally, their anti-inflammatory effects may alleviate symptoms associated with inflammatory conditions like arthritis and allergies.

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Beyond internal health benefits, pomegranate and orange peel extract also show promise in skincare products. Their antioxidant and antimicrobial properties make them valuable ingredients for combating signs of aging, reducing acne, and promoting skin rejuvenation. Moreover, their natural astringent qualities can help tighten pores and improve skin texture.

Furthermore, the combination of pomegranate and orange peel extract offers a refreshing and tangy flavour profile that can enhance the taste of various culinary creations, from beverages to desserts. Whether incorporated into smoothies, teas, or marinades, their vibrant flavours add depth and complexity to dishes while providing a nutritional boost.In conclusion, the blend of pomegranate and orange peel extract represents a powerhouse duo with multifaceted benefits for health, skincare, and culinary endeavours. Harnessing the natural goodness of these extracts may contribute to a healthier lifestyle and a more vibrant, radiant appearance

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